

Japan's energy policy during the 1950s: reasons for the rapid switch from coal to oil

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Introduction

The energy revolution, the switching of energy resources from domestic coal to foreign petroleum, was one reason underlying the golden age of 1960s capitalism. It universally affected developed countries. In 1959-1960, both the Organization for European Economic Co-operation (OEEC) and the Japanese government declared officially that cheap foreign oil made the energy revolution inevitable¹; thereafter their coal mining industries began a long decline.

However, we can also find various underlying factors of the energy revolution and attempts to alter its course. This paper specially examines the characteristics of Japan, which industrialized more rapidly than any other country at that time. Table 1 shows three important points distinguishing Japan. First, Japan was industrialized country that was most dependent on oil in 1973: Japan's rate of energy self-sufficiency was lowest. Second, the Japanese energy revolution was more rapid than that of Italy, a similarly energy-dependent nation. Whereas oil's share of energy use in Italy was already 31.78% in 1950, that in Japan was only 6.15%; this percentage was the lowest aside from that of West Germany. Third, Japan's rapid energy revolution had occurred not only during the 1960s but also during the 1950s. The Japanese dependence on oil became 38.32%, which rivaled the dependency of Italy and the U.S., which had shown high dependence on oil even before WW II.

Therefore, the purpose of this paper is to present analyses of the reasons for the rapid Japanese energy revolution, particularly addressing Japanese energy policy during the 1950s. Almost all studies in the relevant literature have emphasized that the keynote of the energy policy during the 1950s was protection of the coal-mining industry². Those conclusions demand re-examination. Their most supportive evidence regulation of heavy oil consumption in 1954 through administrative guidance, the Coal Mining Industry Rationalization Temporary Measures

¹ OEEC (1960), Miyajima (1991).

² See, for example, Hein (1990) Chaps.10-11, Samuels (1987) Chap.3-5, Takeda (1991), The Institute of Energy Economics, Japan (1986).

Law enforced in 1955, in addition to the Law on Temporary Measures Regarding Restriction on Installation of Heavy Oil Boilers (Heavy Oil Boilers Regulation Law) which was undertaken to regulate the consumption of heavy oil. Furthermore, that study proved that the decreasing petroleum price after 1958 altered this 'coal first–oil second' policy. Results of those analyses apparently show that, although the government tried to prevent the energy revolution, it rapidly became overwhelmed by cheap oil. According to earlier studies, the Japanese government was passive, but that conclusion has not been based on sufficient evidence.

Actually, Takayuki Terada insisted that regulation of heavy oil consumption was marginal³. Terada did not, however, examine the purpose of the policies or the course of the policy-making or policy practice.

Therefore, this paper, through presentation of an examination of the regulation of heavy oil consumption as it was actually carried out during 1954–1960, presents analyses of the reaction of Ministry of International Trade and Industry (MITI) to the progress of the energy revolution. It describes the author's reconsideration of the reasons for the rapid switch from coal to oil.

Section 1 describes how the energy revolution progressed in major industries, particularly addressing heat control (*netsukanri*), which is a technique to improve energy efficiency at a facility using large amounts of fuel for production. Section 2 examines the government's reaction, comprising three stages. First, we investigate the heat control policy during the first half of the 1950s and consider the government reaction to conversion from coal to oil. Second, we investigate the process by which the regulation of heavy oil consumption by administrative guidance and Heavy Oil Boilers Regulation Law was made and enforced after 1954. In analyzing that policymaking, we direct our attention to MITI, Japan Federation of Economic Organization (*Keidanren*) and several politicians belonging to conservative parties. We also research the points upon which they agreed or disagreed. Third, we analyze the manner in which the enforcement of the Heavy Oil Boilers Regulation Law was relaxed after 1956 and examine its subsequent revision in 1960. We therefore present characteristics of Japan's energy policy during the 1950s.

1 Conversion from Coal to Oil during the 1950s

Outline of conversion to oil and the heat control

³ Terada (2000a, 2000b).

During 1951–1960, the demand for oil in Japan increased at a rate of more than 25% a year, from 356 million kl to 3,000 million kl. During this period, heavy oil consistently accounted for 60% of all oil demand. The demand for oil in 1960 amounted to more than 1,800 million kl⁴. These increases in demand for heavy oil were attributable only to the expansion of energy market but also to conversion from coal.

The option of choosing heavy oil or coal depends mainly on the cost that is expected to be paid up to the point that each fuel is to be used. These costs depend on two factors: the price of coal and heavy oil, and the costs that are incurred through use of coal and heavy oil.

First, the price of coal and heavy oil are compared (Fig. 1). The price of general-use coal was higher than that of Grade C heavy oil from autumn of 1951 to autumn of 1954, and after May 1958. For Grade B heavy oil, the price of general-use coal was lower, except between autumn 1951 and autumn 1953. From the price viewpoint, the heavy oil economy was not established between 1955 and 1957. Fundamentally, this resulted from the rise in the imported crude oil price induced by the Suez crisis.

The difference of the costs incurred when coal and heavy oil are used must be considered. In fact, it is this factor which made heavy oil more useful than its price. Heavy oil is generally more useful than coal for purpose of heat control, i.e. for transport, storage, and thermal efficiency. Against the background of the supply–demand situation of coal becoming severe during wartime, Japanese industry started to work on heat control and sought to use heavy oil for heat control from the beginning of the 1950s⁵. As portrayed in to Table 2, the advantages of heavy oil differed among facilities; it was much more advantageous for use in open-hearth furnaces, glass furnaces and heat-treating furnaces than in rotary kilns for cement work and every type of boiler. In industries using furnaces, conversion to heavy oil seems to have been rapid because it was more useful for heat control and was able to decrease costs to a greater degree than the mere difference between the spot price of coal and oil⁶.

How did the increase in demand for heavy oil and the conversion from coal to heavy oil progress in various industries? As presented in Table 3, conversion to heavy oil progressed rapidly

⁴ Petroleum Association of Japan (1985) p.374.

⁵ Kobori (2006).

⁶ Japan Development Bank (1959). The advantage of heavy oil over coal was called 'Merit' at that time.

during two short periods: 1952–1953 and 1957–1960. As presented below, we examine tendencies of the conversion to heavy oil and their effects on manufacturing. We specifically examine two major consumers of heavy oil: the iron and steel industry and the electric power industry.

Iron and steel industry

Fuels used by the iron and steel industry comprise coal, heavy oil, and gas produced at coke ovens and blast furnaces. During steel processing, the conversion to heavy oil progressed in the order of open hearth furnaces, rolling mills, and boilers (Table 4). The reason for this step-by-step situation was the difference of heavy oil's capabilities for heat control at respective facilities.

During the interwar era, the main energy for open-hearth furnace was gas-producing coal. After the war, however, without the resources of Manchuria, the supply–demand situation of gas-producing coal tightened; domestic coal was unsuitable for producing gas. The motivation to use gas-producing coal decreased⁷. In fact, GHQ/SCAP recommended that the Japanese iron and steel industry use heavy oil for open-hearth furnaces to improve heat control. The Japanese iron and steel industry accepted this recommendation and the use of heavy oil was adopted very quickly. During wartime, the heat control had been the most important technical issue for the Japanese iron and steel industry, which had started training workers to improve heat control. The Japanese iron and steel industry was ready to understand the recommendation by GHQ/SCAP and was ready to adapt more readily than anyone had expected. Both the abolition of oil price control and a long strike of the coal-mining industry occurred in 1952, thereby hastening the conversion to oil. In the first half of the 1950s, the energy consumption rate in the Japanese open hearth furnaces became the lowest in the world (Fig. 2), owing to the combination of heavy oil and highly trained workers. In contrast, the iron and steel industry in West Germany did not use heavy oil; although the U.S. foundries used oil, the U.S. lacked careful heat control techniques used by trained workers⁸.

After L–D converters began to be installed in place of open-hearth furnaces from the end of

⁷ “The report by the Commission on Open-Hearth Furnace” (December 20, 1948) p.203, in Japan Iron and Steel Federation(1992).

⁸ Kobori (2008).

the 1950s, heavy oil consumption in open-hearth furnaces began to decrease. In its place, heavy oil consumption in rolling mills increased because of improvement of both heat control and the pre-treatment of iron ore, the latter of which slashed the coke ratio during the 1950s. The amount of blast furnace gas and coke-oven gas became insufficient for the amount of steel production.

Regarding boilers, the conversion to oil was greatly delayed because the advantage of heavy oil was low. The amount of the consumption of heavy oil finally became equal to that of coal in 1962.

Electric Power Industry

During 1952–1955, the share of heavy oil was around 10%. Rapid conversion to heavy oil started in 1957; the share became about 40% in 1960 (Table 2).

Such increases of heavy oil consumption accompanied a change in the aim of heavy-oil use. In 1951, the supply–demand situation of coal became tight, so plenty of heavy oil and coal was imported for use by the electric power industry. At that time, effects of using heavy oil—fewer accidents, stability of supply, increased output, and so on—were recognized⁹. Furthermore, as power plants began to use more low-quality coal, it became increasingly necessary to use heavy oil when power stations started to generate electricity¹⁰. During the early 1950s, the role of heavy oil was to assist combustion, so the quality of heavy oil, rather than its price, rose in importance.

However, as the demand for electricity grew rapidly in 1956, the shortage of domestic coal for power plants became a concern in addition to increased heavy oil consumption. Furthermore, the electric power industry began to demand government permission to build boilers to burn heavy oil exclusively because such heavy-oil boilers could burn at the lowest price. As policies of “fire first–water second” progressed after 1956, the role that heavy oil was expected to fill changed from assistance of combustion to that of a stable and abundant supply of fuel¹¹.

Conclusion

⁹ Suzuki (1954), MITI Public Utilities Bureau (1952), pp.260-61.

¹⁰ Akabane (1954), p.47.

¹¹ Kobori (2005).

The energy revolution progressed among multiple avenues during the 1950s. In industries using facilities in which the advantages of heavy oil were high, such as open-hearth furnaces of iron and steel industry, heavy oil was much preferred to coal for rationalization, i.e. heat control. The energy revolution progressed gradually immediately after the war. Its pace increased from 1952 or 1953, and the energy revolution had already finished in the second half of the 1950s. For the electric power industry, which used heavy oil mainly for boilers, heavy oil was used to assist burning in the first half of the 1950s. The rapid conversion to heavy oil happened in a few years from the end of the 1950s. Even in the iron and steel industry, the conversion to heavy oil in boilers lagged behind that in open-hearth furnaces and rolling mills. These tendencies applied also to other industries using boilers. These results show that the energy revolution was occurring more rapidly in facilities where the advantage of heavy oil on heat control was greater. The next section presents an explanation of how MITI reacted to this step-by-step situation of the energy revolution.

2Energy Policy during the 1950s

(1)Heat-Control (*netsukanri*) Policy encouraging conversion from coal to heavy oil

Heat control was not only exercised by industries but also encouraged by the government (heat control policy)¹². The heat control policy originated from technical guidance for fuel burning (*nensho shido*), which encouraged improvement of a factory's technology to burn fuel. The technical guidance for fuel burning started in Osaka in the 1920s, from where it was familiarized throughout the whole country as one industrial rationalization policy. In war and reconstruction periods, against the background of the tight supply–demand situation for coal, the technical guidance for fuel burning expanded in the interest of implementing comprehensive fuel saving methods at a plant and developed to the heat-control policy. The purposes of the heat control policy after war were both industrial rationalization and domestic energy preservation.

The Rule of Heat Control was enacted in February 1947; the Heat Control Law was issued in March 1951. The Heat Control Law was aimed at preserving fuel resources and rationalizing firms through more efficient use of heat energy. The Heat Control Law designated factories using more fuel than 1,000 ton of coals (6,000kcal/kg) annually as the Designated Heat Control

¹² Kobori (2007).

Factories, which were obliged to select a Heat Controller, who was obligated to pass the national examination and become a Qualified Person for Heat Control. Training and lessons for becoming a Qualified Person for Heat Control were often held. The heat control policy was promoted by the Heat Control Division of the Agency of Industrial Science and Technology and the MITI-affiliated Resources Technology Laboratory (changed from the Fuel Research Laboratory in April 1952). Furthermore, the Central Council for Heat Control and eight local associations for heat control were established as private institutions of heat control.

The government promoted conversion from coal to heavy oil to develop heat control in the early 1950s. For example, the Agency of Industrial Science and Technology asked the Japan Development Bank to finance conversion to oil and lectured on heavy oil's supremacy to coal at lessons for becoming Qualified Person for Heat Control. The Central Council for Heat Control also encouraged conversion to heavy oil through its journal, *Netsukanri*¹³. Therefore, in the first quarter of the fiscal year 1952, only 17% of Designated Heat Control Factories used heavy oil; by the forth quarter, this index rose to 33.6%¹⁴. Until the first half of the fiscal year 1953, the conflict between the coal-mining policy and the heat-control policy had not existed.

(2) Regulation of Heavy Oil Consumption by Administrative Guidance

MITI Changing Its Policy

The attitude toward promoting conversion to heavy oil began to change at the end of 1953. Two factors were involved. First, the affairs of coal-mining companies worsened because the stock of coal had increased. Therefore, in the middle of 1953, the coal-mining industry started to agitate for restriction of the imports of crude and heavy oil¹⁵. Second but simultaneously, it was certain that the balance of payments had worsened. Because of these two factors, some departments of MITI insisted on the restriction of oil imports through foreign exchange allocation.

When the foreign exchange budget for 1954 was made, MITI decided to guide heavy oil

¹³ *Netsukanri*, December 1952 (a special issue number on the burning of heavy oil), March 28th 1953 (an extra issue with information on the technology of heavy oil burning), *Netsu to keiei*, Vol.1, No.3 (June 1952) p.48.

¹⁴ The Central Council for Heat Control (1953).

¹⁵ The coal Association of Japan "Sekitan-kogyo tomen no kiki-dakai ni tsuite" (On Temporally Solutions for the Crisis of Coal-Mining Industry), July 1953, in Nippon Oil Co. (1953), pp.191-212.

consumption toward the same amount of the prior year of 1953 (537 million kl)¹⁶. What were the grounds for that goal? The chief of this policy explained it as described below at Keidanren¹⁷. Japan had to secure demand for coal through regulation of heavy oil demand such that smaller amounts of coal production would make coal production costs higher. Thereby, a reduction in coal prices, which was requested from the industrial world, would become impossible. This logic dictates that the continuing conversion to heavy oil would shrink the coal market, coal production costs would become higher, and consumers' fuel cost would be higher. It would thereby become increasingly difficult to cut fuel costs.

After spring in 1954, MITI started to consider how to adjust the demand for coal and heavy oil¹⁸. On March 30, 1954, the Cabinet agreed with 'On Coal and Oil Adjustment', which was produced by MITI. This report described that the main energy resources would be the domestic coal and water, so the import and consumption of heavy oil should be reduced.

In May 1954, MITI presented a means to coordinate heavy oil consumption¹⁹. Actually, MITI tried to set, for every oil distributor, a limit on the amount of heavy oil sales and to set for every industry and every large consumer a limit on the amount of heavy oil purchased. At that time, MITI planned to supply heavy oil with priority to open-hearth furnaces and facilities producing goods for export; MITI established the Coordination Committee for Heavy Oil Supply and Demand. Consequently, MITI tried to limit heavy oil consumption to 537 million kl annually through exercising these policies in the first and second halves of fiscal year 1954.

Keidanren's Reaction

At the beginning of 1954, Keidanren started the Committee for Fuel in earnest. The Committee for Fuel was met six times during February–June 1954 and published a request for MITI's regulation of heavy oil consumption, in the name of Keidanren²⁰. Keidanren said, "[Because t]he marked progress of heavy oil consumption cannot be left alone...in the viewpoint of the balance of payments...we do not regret the principle of the policy." It added however, that,

¹⁶ *Sekiyu Keizai Shimbun*, April 1, 1954.

¹⁷ *Keidanren shuho*, April 9, 1954.

¹⁸ "Sekitan to juyu no chosei ni tsuite" (On Coal and Oil Adjustment) March 30, 1954 (IIP,V18)

¹⁹ IIP, V18.

²⁰ *Keidanren geppo*, July 1954, p.45.

“It is dangerous to exercise measures to reduce heavy oil consumption rapidly.” It requested that measures be made moderate and that they be undertaken to reduce the consumption and imports of other goods.

This reaction should be evaluated as described bellow. Keidanren could not oppose the principle of the reduction of heavy oil consumption completely. Although every industry requested that the government supply it with sufficient heavy oil, it could not but recognize two points. First, the collapse of the coal-mining industry would be a great loss to national economy. Second, imports ought to be reduced because of the balance of payments. These objectives were consistent with the then economic circle's opinion at the time, which strongly sought improvement of the balance of payments and price stabilization. Therefore, although every industry admitted the principle of the policy, it otherwise sought a means to obtain heavy oil. Keidanren did not have the authority to measure each industry's opinion. Although Keidanren could agree more costs of coal-mining policy and balancing of payments had to be transferred to agriculture, fisheries, or medium and small companies which did not belong to Keidanren, it was unable to coordinate the allocation of heavy oil to its member industries. Therefore, each industry decided to be present at the MITI-affiliated Coordination Committee for Heavy Oil Supply and Demand and lobbied to get as much oil as possible allocated to its own interests.

Regulation by Administrative Guidance and its effect

In May 1954, MITI established the Coordination Committee for Heavy Oil Supply and Demand. With five private members, it discussed regulation of heavy oil consumption in the first half of the fiscal year 1954.

In MITI's first plan, the limit of the supply of heavy oil would be reduced to 79.3% of the amount of the demand (Table5). Furthermore, MITI announced that if a supplier violated its limit, the supplier's foreign exchange allocation would be reduced in the second half of the fiscal year 1954. Actually, MITI tried to use foreign exchange allocation to make its administrative guidance more effective²¹.

On the demand side, MITI suggested not to reduce the demand through internal-combustion engines and particular furnaces too much but to reduce the demand instead by general boilers

²¹ *Keidanren shuho*, June 11, 1954.

severely²². Therefore, in MITI's first plan, the percentage of reduction of the big users of mining and manufacture was less than that of the small users and 'others' mainly consisting of businesses using heavy oil for heating or cooking.

After discussion at the Coordination Committee for Heavy Oil Supply and Demand, the final plan, which increased the supply by 17 million kl, was determined²³. In fact, MITI exercised the regulation of heavy oil consumption standing on this last plan, but each local bureau of MITI urged modification of the plan. For example, the Osaka Bureau of International Trade and Industry requested that MITI increase the supply of heavy oil by 5.7%²⁴. Each local bureau of MITI was left to local industrial administration and was not in a position to consider a coal-mining rationalization policy. Therefore, it was critical of MITI's regulation of heavy oil consumption. MITI accepted these opinions and flexibly moulded the final plan²⁵.

Consequently, in fiscal year 1954, the amounts of sales of heavy oil and coal were both flattened, but the conversion from heavy oil to coal did not progress merely by virtue of administrative guidance. The aim of MITI did not come true.

(3) Regulation by Heavy Oil Boilers Regulation Law

Making of the Heavy Oil Boilers Regulation Law

MITI acted to the limit of the administrative guidance: at last, in the second half of October 1954, it started to prepare legal regulation of heavy oil consumption. The main sections that produced the Bill were the Mining Bureau and the Coordinating-Supplies Division and General Division of the Minister's Secretariat. In May 1955, MITI presented the Cabinet with the Heavy Oil Boilers Regulation Bill. The outlines of Heavy Oil Boilers Regulation Bill were the following three points. First, establishment of heavy oil boilers, whether oil-burning boilers or coal-and-oil-burning boilers, was prohibited except by MITI's admission. Second, MITI was able to prescribe to every business the conversion of heavy oil boilers into other types of boilers and the prohibition or reduction of heavy-oil consumption. Third, it was a 10-year temporary law²⁶.

²² *Ibid.*

²³ *Keidanren shoho*, July 2, 1954, *Sekiyu Keizai Shimbun*, June 29, 1954.

²⁴ Tsusansho Koho (Kansai-ban), August 21, 1954.

²⁵ *Sekiyu Keizai Shimbun*, August 17, 1954.

²⁶ "Juyū boira no secchi no seigen-tou ni kansuru rinji-sochi ni kansuru houritsu-an" (The Bill on

Below is an examination into the mode of policy-making of the Heavy Oil Boilers Regulation Bill in MITI.

Although administrative guidance was targeted for all facilities, the Bill was considered to be targeted mainly for boilers from autumn of 1954 when MITI started to make it. In November 1954, the Coordinating-Supplies Division said, "...in order to realize right production amounts of coal...we must also urge to conversion of existent oil-burning facilities...into coal-burning facilities." The Coordinating-Supplies Division also related that when the coal-mining industry was rationalized and the price of coal decreased to the same as heavy oil, the cost of using coal in boilers would be equal to that of heavy oil. Therefore, the Coordinating-Supplies Division concluded that, in boilers, the government had to restrain conversion to heavy oil and to encourage conversion to coal. However, the Coordinating-Supplies Division held that in open-hearth furnaces, glass furnaces, and heat-treating furnaces, heavy-oil use would be extremely effective even after the coal-mining industry was rationalized. Therefore, the Coordinating-Supplies Division declared, "[to these facilities] we even hereafter permit the use of heavy oil because we must consider the international competitiveness on the cost and quality of products."²⁷ This policy resulted from the process in which, standing on the information from every Bureau of MITI, the Coordinating-Supplies Division calculated every facility's cost of coal and heavy oil expected after coal-mining rationalization (Table 6).

That is to say, MITI's policy was to assign coal to use in boilers and heavy oil to others (Table7). When the domestic coal-mining industry was rationalized, the fuel costs would present no problem, whether its facility is a boiler or a furnace, so all aims of the energy policy were to be solved. This principle was consistent from the viewpoint of regulation of heavy oil that was finalized in 1954.

Discussion at the Diet on Heavy Oil Boilers Regulation Bill

In June 1955, discussion on Heavy Oil Boilers Regulation Bill started at the Commerce and Industry Committee of the House of Representatives. At the discussion, although both wings

Temporary Measures Regarding Restriction on Installation of Heavy Oil Boilers) (ITP536-2).

²⁷ The Coordinating-Supplies Division "Juyu no jukyuu-chosei wo okonau riyuu oyobi sono han-i ni tsuite (sanko-shiryō)" (On reasons for regulation of the supply-and-demand of heavy oil and the extent of it (morgue)) November 19, 1954, (unpublished document of MITI).

of the Socialist Party of Japan agreed to the Bill, both the conservative parties (Democratic Party [DP, the government party at that time] and the Liberal Party [LP]) disagreed with it.

The main criticism from conservative parties was that the Bill would aggravate the international competitiveness of export industries. For example, “[dyeing businesses] cannot make dyed goods for exporting without heavy oil boilers. Even if they were able to do so, their goods would be unable to compete with foreign goods²⁸” and “exports by medium and small companies have been growing since the end of last year. We think it is because their fuel has been converted to heavy oil. It has expanded their production very much²⁹.” Against such criticism from the conservatives, the chief of Mining Bureau of MITI explained that facilities aside from those with boilers would not to be the target of the regulation of heavy oil consumption. He further explained that the facilities for which the advantages of heavy oil to coal are clearly high would not be forced into converting from oil to coal.

After these discussions, DP and LP presented the amendment of the Bill together at the end of July 1955. By this amendment, MITI became able to prescribe to businesses that had heavy oil boilers only when its prescriptions would not worsen the quality of products or not decrease exports. In addition, the term of enforcement was shortened from 10 years to 5 years. Consequently, the Heavy Oil Boilers Regulation Law, which was amended at the Diet, was issued in August 1955 and was enforced in October of the same year.

Both conservative parties succeeded in putting MITI's reply into the Law and in limiting the target of the regulation of heavy oil consumption beforehand and clearly. Therefore, it became certain that the enforcement of Heavy Oil Boilers Regulation Law would not be reinforced even if the affairs of the coal industry worsened further. However, seeing the fact that the Bill had not been rejected, we can understand that both conservative parties, as had MITI and Keidanren, strove to support the domestic coal industry to some degree. The discussion at the Diet was a conflict between MITI, which sought to retain as many measures as possible, and the conservative parties, which sought to check MITI's power. Their principle was not different at all. It was that Japan should realize both rationalization of the coal industry and the minimization of its costs

²⁸ By Tanaka Isaji (Liberal Party), at Commerce and Industry Committee of the House of Representatives, June 24, 1955 (Kokkai kaigiroku).

²⁹ By Hasegawa Shiro (Democratic Party), at Commerce and Industry Committee of the House of Representatives, June 24, 1955 (Kokkai kaigiroku).

suffered by other industries.

Enforcement of the Heavy Oil Boilers Regulation Law

After enforcement in October 1955, the number and amount of established heavy oil boilers increased annually. In addition, oil-burning boilers were more numerous than coal-and-oil-burning boilers after 1957 except in the electric power industry, of which all boilers were coal-and-oil-burning until 1959. Prescriptions to existent heavy oil boilers were exercised as below. There were 25 “conversions” into boilers of other types (a decrease by 13,000kl), 65 “reductions” of heavy oil consumption (a decrease by 600kl) and 31 “prohibitions” of heavy oil consumption (a decrease by 800kl). Therefore, 121 prescriptions converted 14,400kl of heavy oil into coal³⁰. When MITI presented the Bill, MITI had planned to convert 312 of 543 existing boilers into coal-burning boilers by 1957. Furthermore, MITI had planned to convert 59,000kl of heavy oil during the fiscal year 1956. Therefore, the enforcement of the Heavy Oil Boilers Regulation Law fell vastly below MITI's original plan. In addition, these prescriptions were halted in November 1956³¹. In next section, we present analyses of why the regulations started to relax in 1956 and why the Heavy Oil Boilers Regulation Law was revised in 1960.

(4) Relaxation and Revision of Heavy Oil Boilers Regulation Law

Why were these prescriptions stopped in November 1956? Actually, MITI explained that it was because “the supply–demand situation for coal tightened³²”. In fact, MITI apparently inferred that the encouragement of conversion into coal would only make coal more expensive and that the coal industry would not be pressed even if the supply of heavy oil were increased.

It is noteworthy that the rapid growth of energy demand was considered not as a temporary

³⁰ “Setsumeishiryo (dai 43 kokkai yo)” (Materials for the 43rd Diet) 1963, MITI, Mining Bureau, Oil Division, “Juyuboira no secchi no seigen-to ni kansuru rinjisochi ni kansuru houritsu' unyo jisseki” (Results of the enforcement of the Law on Temporary Measures Regarding Restriction on Installation of Heavy Oil Boilers) October 1, 1959 (unpublished documents of MITI), MITI (1960), pp.2-3.

³¹ “Juyuboira no secchi no seigen-tou ni kansuru rinji-sochi ni kansuru houritsu-an huhyo” (Supplementary tables to the Bill on Temporary Measures Regarding Restriction on Installation of Heavy Oil Boilers) (*JTP*, 536-2), “Housikou jokyō” (The state of the enforcement of the Law) 1956, (unpublished document of MITI).

³² MITI, Research Division (1956) p.177.

event but as a long-term trend. The Economic Planning Agency (EPA) issued the statement that, “the production of producer goods, especially machinery grew in the fiscal year [1956] meant that Japan’s economy became a type of industrial structure using much steel,” and emphasized that this phenomenon had caused the lack of energy. In addition, the EPA indicated that Japan’s economy could not grow smoothly without expansion of the energy supply, and predicted that, although the electric power industry’s shift to a ‘fire first–water second’ structure would increase energy consumption, it would not be easy to hasten production of coal, so the production cost of coal would increase. The EPA also predicted that a domestic energy shortage would rapidly increase the demand for oil³³. In short, EPA noticed that the boom in 1956 took place against the background of the change of industrial structure (growth of heavy industries) and acknowledged two points. First, the speed of the increase in energy supply should be hastened to sustain economic growth. Second, the amount of crude oil imports should increase to support the first goal.

The EPA and MITI produced similar ideas. In fact, on December 10, 1956, the MITI-affiliated Industrial Rationalization Council Energy Committee predicted that the amount of crude oil imports would increase rapidly in spite of hastening production of coal and proposed to prepare for it, for example, by securing the foreign resources of oil and expanding the production of tankers and ports as oil terminals³⁴. In fact, the ports in Japan were not as deep and good as those in the West at that time (Table8). The government decided that the government and municipalities would subsidize the dredge of main ports for oil imports from 1957. Some cities along the Pacific coast, such as Yokohama, Chiba, and Tokuyama, had also begun reclamation and some bigger refineries with deeper ports were established on the reclaimed ground³⁵. In 1956, although heavy oil was still more expensive than coal, policies for using more heavy oil were started. The long-term rapid increase of demand for energy and the limit of domestic coal production was apparently absolute: greater dependence on imported crude oil was considered inevitable.

In 1959, the year preceding the lapse of Heavy Oil Boilers Regulation Law, Keidanren

³³ EPA (1957) pp.33-89.

³⁴ MITI (1957).

³⁵ Petroleum Association of Japan (1957) pp.68-69, Nippon Oil Co. (1957), February 1957, p.156, April 1957, p.333, The Asahi Shimbun (1987), City of Yokohama (1992).

again held the Committee for Fuel. The main issue was whether heavy-oil-only burning power stations would be permitted because permitting them would cause an explosion of heavy oil consumption³⁶. Eventually, in December 1959, although Keidanren permitted extension of the Heavy Oil Boilers Regulation Law for another three years, it advised that the prohibition on heavy-oil-only burning power stations should be abolished³⁷. Each industry apparently considered that electric power industry's much greater consumption of heavy oil would contribute to each industry through stable and low-priced power supplies. Therefore, Keidanren was able to advance a clearer proposal than in 1954. Their logic in 1959 apparently differed from that in 1954, when each industry had been anxious about the other industries' growth of heavy oil consumption.

In 1960, although the Heavy Oil Boilers Regulation Law was extended for three years, two points of the Law were revised. First, small boilers were excluded from regulation. Second, heavy-oil-only burning power stations were permitted. The first points resulted from the heat-control policy that made much of the greater advantage of heavy oil in small boilers than in big boilers (Table1). The second point was the result of a prediction that the supply of domestic coal for the electric power industry could never catch up with the rapidly increasing demand for electricity; it would render greater dependence on heavy oil unavoidable³⁸. Permission not only for small boilers but also for heavy-oil-only burning power stations meant that the extension of Heavy Oil Regulation Law was nominal and that the regulation of heavy oil consumption had substantially ended. In fact, from 1960, the number of established heavy oil boilers increased extremely. The change of Japan's energy policy, which was the result of rapid growth of the demand for energy, started in 1956 and had been completed by 1959.

Conclusion

From the outset the regulation of heavy oil consumption was not difficult. It stood as the background of efforts at heat control (*netsukanri*), which became active from the post-war period. Although MITI considered that the coal-mining rationalization policies were necessary from the viewpoint of national economy (retaining foreign exchange and conserving domestic resources), it

³⁶ *Keidanren shuho*, August 21, November 18, 24, October 8, 29.

³⁷ *Keidanren geppo*, January 1960, pp.6-7.

³⁸ Kobori (2005).

did not overlook the fact that heavy oil improved the heat control and contributed to upgrading of the quality of products and increasing exports. MITI therefore actively accepted the use of heavy oil for facilities in which the advantage of switching from coal to heavy oil was very high, such as the use of open-hearth furnaces, so MITI tried to use advantage of heavy oil to the greatest extent possible. In fact, MITI fully considered the step-by-step situation of the energy revolution in the middle of the 1950s at which time the conversion to heavy oil of some furnaces and small boilers was more progressive than that of big boilers.

Viewing the substance of the regulation of heavy oil consumption and the efforts at heat control, we realized that MITI made a point about policies which encouraged firms to decrease unit fuel consumption (energy-saving policy). This energy-saving policy was an industrial rationalization policy. The substance of regulating of heavy oil consumption also shows that the energy-saving policy was set above the protection of the domestic coal-mining industry. Even if MITI respected for the domestic energy resources, its respect was not unlimited.

In the mid-1950s, however, MITI, the industrial world, and politicians of the conservative parties viewed domestic coal reasonably as a main energy resource and inferred that rationalization of the coal-mining industry was necessary from the viewpoint of the national economy. In fact, their conflicts were related not to the principle but to specific means to regulate the selection of fuels. The government's and the industrial world's recognition began to change after they were made aware in the autumn of 1956 that future energy demand would grow rapidly. It was recognized that if the regulation of heavy oil consumption were continued, it would tighten the supply–demand situation for coal seriously; consequently, the decrease of coal prices, which was the purpose of the coal-mining rationalization policy, would have become impossible. From 1957, the government therefore started some policies to increase Japan's ability to import crude oil. For example, the government improved several ports so that larger tankers would be able to use them. Larger tankers would support higher volumes of oil imports and lower, stable prices. In fact, Japan used the biggest class of tankers in the world from the latter 1950s. Eventually, in 1959, regulation of heavy oil consumption virtually halted and the promotion of the energy revolution was adopted in subsequent policies. During the latter 1950s, Japan's energy policy was gradually changing and finally diverted, not because Japan reacted to the decreasing price of oil passively but because the government and the industrial world had attempted to make various advance

provisions for the long term and rapid growth of energy demand.

The Japanese government consistently emphasized firm's energy-saving during the 1950s and made various advance provisions for the long-term and rapid growth of energy demand in the second half of the 1950s. Based on these two characteristics, the protection of the domestic coal industry was a marginal aspect of Japan's overall energy policy. Furthermore, Japan's energy revolution was more rapid and more comprehensive than similar processes taking place in European countries.

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Table 1. Total primary energy requirements and the percentage of each energy source 1925--1973

(million metric tons oil equivalent, %)

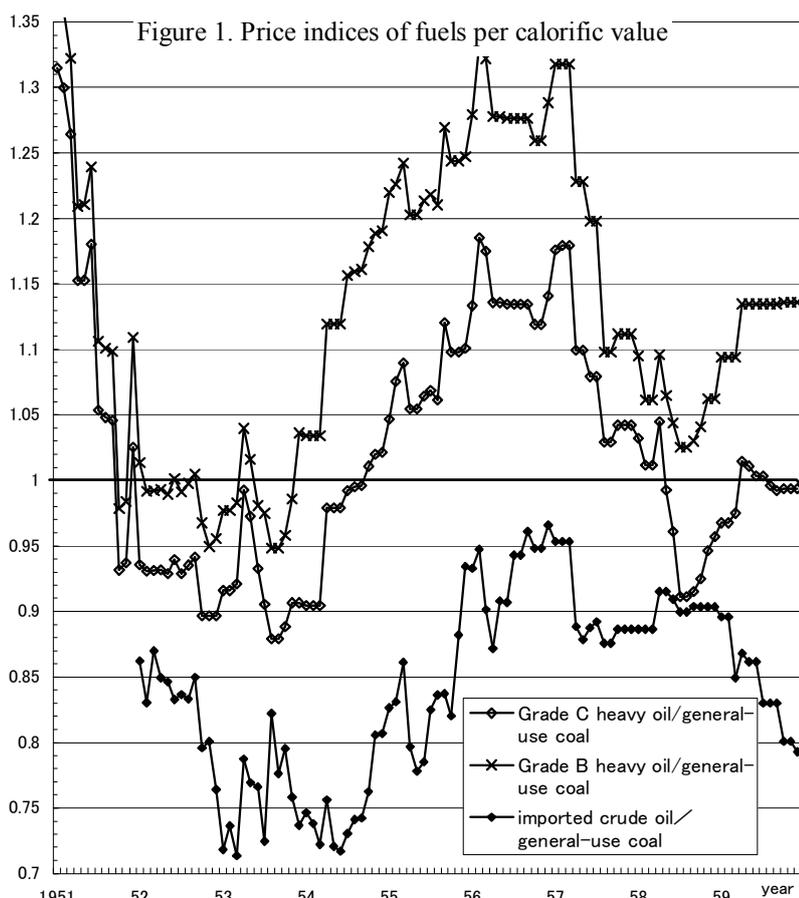
| year | Japan | | | | | France | | | | | West Germany | | | | |
|------|--------|----------------|------|------|-------|---------|----------------|------|------|-------|--------------|----------------|------|------|-------|
| | TPER | Percentage of: | | | | TPER | Percentage of: | | | | TPER | Percentage of: | | | |
| | | Solid | Oil | Gas | Hydro | | Solid | Oil | Gas | Hydro | | Solid | Oil | Gas | Hydro |
| 1925 | 20.32 | 92.4 | 4.4 | 0.1 | 3.1 | 50.35 | 95.5 | 3.7 | 0.0 | 0.8 | 107.79 | 98.7 | 1.1 | 0.0 | 0.2 |
| 1938 | 41.62 | 83.6 | 11.5 | 0.1 | 4.8 | 52.10 | 85.7 | 12.5 | 0.0 | 1.8 | 148.91 | 96.3 | 3.3 | 0.0 | 0.5 |
| 1950 | 30.54 | 83.2 | 6.1 | 0.2 | 10.4 | 54.14 | 77.4 | 19.7 | 0.4 | 2.5 | 85.51 | 94.6 | 4.4 | 0.0 | 1.0 |
| 53 | 45.62 | 75.4 | 16.8 | 0.2 | 7.6 | 60.03 | 73.0 | 23.7 | 0.4 | 2.9 | 105.93 | 92.9 | 6.1 | 0.1 | 0.8 |
| 55 | 44.30 | 68.4 | 22.1 | 0.3 | 9.1 | 65.42 | 67.6 | 28.7 | 0.4 | 3.3 | 121.12 | 89.9 | 8.8 | 0.4 | 0.9 |
| 57 | 60.27 | 65.2 | 26.5 | 0.5 | 7.8 | 78.07 | 68.5 | 28.2 | 0.6 | 2.7 | 129.54 | 86.8 | 12.0 | 0.4 | 0.8 |
| 60 | 74.00 | 54.1 | 38.3 | 1.0 | 6.6 | 80.83 | 58.6 | 34.0 | 3.2 | 4.2 | 136.25 | 76.0 | 22.5 | 0.5 | 1.0 |
| 63 | 104.37 | 40.6 | 52.3 | 1.6 | 5.5 | 94.82 | 49.4 | 42.1 | 4.7 | 3.9 | 162.65 | 65.4 | 33.0 | 0.9 | 0.8 |
| 65 | 125.76 | 35.5 | 58.4 | 1.4 | 4.7 | 110.29 | 41.6 | 50.5 | 4.3 | 3.6 | 182.06 | 56.9 | 40.7 | 1.5 | 0.9 |
| 67 | 179.43 | 32.2 | 63.3 | 1.1 | 3.3 | 115.24 | 35.5 | 55.7 | 4.6 | 3.4 | 185.52 | 47.5 | 49.2 | 2.0 | 0.7 |
| 70 | 256.39 | 24.0 | 71.8 | 1.2 | 2.5 | 147.25 | 26.5 | 63.6 | 5.6 | 3.3 | 234.38 | 38.8 | 54.6 | 5.0 | 0.6 |
| 73 | 321.46 | 18.0 | 77.8 | 1.6 | 1.9 | 176.84 | 17.6 | 70.4 | 7.7 | 2.3 | 264.12 | 32.1 | 56.2 | 9.8 | 0.5 |
| year | Italy | | | | | Britain | | | | | USA | | | | |
| | TPER | Percentage of: | | | | TPER | Percentage of: | | | | TPER | Percentage of: | | | |
| | | Solid | Oil | Gas | Hydro | | Solid | Oil | Gas | Hydro | | Solid | Oil | Gas | Hydro |
| 1925 | 8.63 | 83.9 | 9.2 | 0.1 | 6.9 | 121.52 | 96.2 | 3.8 | 0.0 | 0.0 | 478.48 | 74.2 | 19.2 | 6.2 | 0.5 |
| 1938 | 12.78 | 70.5 | 19.6 | 0.1 | 9.8 | 130.91 | 92.3 | 7.7 | 0.0 | 0.1 | 446.29 | 54.4 | 31.8 | 12.9 | 0.9 |
| 1950 | 12.43 | 49.2 | 31.8 | 3.6 | 15.4 | 148.76 | 89.5 | 10.4 | 0.0 | 0.1 | 800.69 | 42.3 | 37.7 | 18.9 | 1.1 |
| 53 | 19.42 | 35.2 | 41.7 | 10.4 | 12.7 | 160.88 | 87.0 | 12.9 | 0.0 | 0.1 | 862.94 | 33.4 | 41.9 | 23.6 | 1.1 |
| 55 | 24.93 | 30.3 | 45.9 | 12.9 | 10.9 | 173.16 | 84.9 | 15.0 | 0.0 | 0.1 | 913.56 | 30.6 | 43.4 | 24.9 | 1.1 |
| 57 | 31.47 | 26.5 | 50.4 | 14.1 | 9.0 | 175.74 | 83.3 | 16.6 | 0.0 | 0.1 | 971.63 | 28.9 | 43.2 | 26.7 | 1.2 |
| 60 | 38.78 | 18.9 | 56.0 | 14.8 | 10.3 | 170.84 | 74.0 | 25.8 | 0.0 | 0.2 | 1,033.39 | 24.6 | 43.7 | 30.4 | 1.2 |
| 63 | 55.68 | 14.8 | 66.2 | 11.6 | 7.5 | 182.72 | 68.9 | 30.8 | 0.1 | 0.2 | 1,152.24 | 23.8 | 43.4 | 31.6 | 1.2 |
| 65 | 66.72 | 11.2 | 72.8 | 10.4 | 5.7 | 193.55 | 64.0 | 35.5 | 0.4 | 0.2 | 1,254.42 | 24.3 | 42.9 | 31.5 | 1.3 |
| 67 | 84.30 | 13.7 | 69.2 | 9.0 | 7.0 | 187.55 | 51.9 | 44.0 | 0.6 | 0.2 | 1,347.95 | 22.8 | 43.5 | 32.2 | 1.5 |
| 70 | 110.75 | 9.8 | 74.3 | 9.6 | 5.2 | 207.76 | 42.8 | 48.8 | 4.9 | 0.2 | 1,545.88 | 21.2 | 44.7 | 32.3 | 1.4 |
| 73 | 130.48 | 7.5 | 76.8 | 10.9 | 4.1 | 220.95 | 34.7 | 50.5 | 11.4 | 0.2 | 1,723.21 | 20.3 | 47.0 | 29.9 | 1.4 |

Sources : (1925--1965) Darmstadter, *Energy in the world economy*, the John Hopkins Press, 1971, (1967-73) IEA *Energy Balances of OECD Countries 1960/1974*.

Notes : 1. West Germany includes East Germany before WW II.

2. The sum of percentages is not always 100 because of atomic energy, import and export of electricity, etc.

3. Metric ton oil equivalent is equal to 1.5 metric tons coal equivalent.



Source : Nippon ginko tokei kyoku (The Bank of Japan, Statistics Bureau), *Oroshiuri bukka sису nenpo* (Annual wholesale price indices).

Notes : 1. general-use coal: source from Hokkaido and delivery in Tokyo Bay, powder, 6,600 kcal/kg, Grade B heavy oil: 9,750 kcal/l, Grade C heavy oil: 9,890 kcal/l (MITI, Research Division, *Sekiyu tokei nenpo* (Annual oil statistics)1954:204), imported crude oil: 9,400kcal/l.

2. Grade C heavy oil is heavier than Grade B.

Table 2. Advantage of heavy oil to coal (heavy-oil-using cost/ coal-using cost)

| Source (1) | | Source (2) | |
|--|---------------|--|------|
| Open-hearth furnaces | 0.49 | Open-hearth furnaces, producing-gas and pottery | 0.70 |
| Melting furnaces | 0.55 | Glass, melting and heat-treating furnaces for metal and coke oven: | 0.75 |
| Heat-treating furnaces for metal | 0.65 | Kilns for cement | 0.85 |
| Glass furnaces | 0.67 | Chemical except used for steam-producing, textiles, and railways | 0.90 |
| Sintering furnaces for pottery | 0.69 | General boilers, food industry | 0.95 |
| Boilers except water-tube boilers | 0.71 | Large boilers at power stations, paper industry, home fireplace | 1.00 |
| other furnaces, stoves, and bathhouses | 0.79 | <i>Sources</i> (1) MITI, Coal Bureau, "Showa 38 nendo sekitan-juyo oyobi kyoukyu-ryo chosa ni tsuite" (On examination into supply-and-demand of coal in fiscal year 1963), December 14th 1959, (Keio University Lib. <i>Collection of the Japanese Coal Industry</i>), COAL@8397. | |
| Water-tube boilers | -10t/h 0.80 | (2) <i>Sofremin's Report on the Japanese coal-mining industry</i> , vol.4, 1957, p.23. | |
| boilers | 10-20t/h 0.82 | | |
| | 20t/h- 0.85 | | |
| Kilns for cement | 0.92 | | |

Table 3. Supply quantities of heavy oil and its percentage to the supply quantities of heavy oil and coal (1,000 kl, %)

| Fiscal year | Total | | Construction and manufacture | | Iron and steel | | Ceramics | | Fabrics | | Food | |
|-------------|------------------------------|------|------------------------------|------|----------------|------|----------------------------------|------|---|------|----------------------------|------|
| | | | | | | | | | | | | |
| 1952 | 3,186 | 10.7 | 1,297 | 8.2 | 619 | 12.6 | 197 | 8.1 | 105 | 10.8 | 60 | 6.9 |
| 53 | 5,560 | 17.2 | 2,892 | 16.2 | 976 | 18.0 | 463 | 16.4 | 331 | 27.4 | 227 | 23.3 |
| 54 | 5,468 | 17.2 | 3,084 | 17.2 | 958 | 19.9 | 545 | 17.5 | 317 | 25.8 | 286 | 26.0 |
| 55 | 5,816 | 17.0 | 3,300 | 16.6 | 1,086 | 19.9 | 537 | 16.6 | 324 | 22.6 | 272 | 21.7 |
| 56 | 7,312 | 18.5 | 3,972 | 17.0 | 1,362 | 20.7 | 552 | 14.2 | 390 | 24.5 | 301 | 22.4 |
| 57 | 8,948 | 20.2 | 4,712 | 18.9 | 1,465 | 20.7 | 821 | 19.4 | 450 | 28.1 | 361 | 25.4 |
| 58 | 9,204 | 23.0 | 5,140 | 23.0 | 1,410 | 22.6 | 947 | 25.2 | 546 | 37.4 | 408 | 29.9 |
| 59 | 12,211 | 26.1 | 7,072 | 26.2 | 2,015 | 24.8 | 1,348 | 30.2 | 596 | 38.6 | 535 | 35.6 |
| 60 | 18,571 | 31.9 | 9,597 | 30.2 | 2,528 | 25.1 | 1,904 | 35.4 | 772 | 44.8 | 681 | 42.0 |
| 61 | 22,931 | 35.1 | 12,269 | 33.5 | 3,008 | 23.7 | 2,510 | 44.3 | 946 | 52.5 | 868 | 50.1 |
| 62 | 28,717 | 41.9 | 15,628 | 41.9 | 3,328 | 26.4 | 3,507 | 58.5 | 1,215 | 66.1 | 1,220 | 62.8 |
| Fiscal year | Construction and manufacture | | | | Electric power | | Heating, cooking, and bathhouses | | Agriculture, forestry, fisheries and mining | | Carrier and correspondence | |
| | Chemical | | Paper | | | | | | | | | |
| 1952 | 58 | 2.1 | 53 | 4.9 | 271 | 7.0 | 276 | 16.5 | 579 | 85.7 | 706 | 15.2 |
| 53 | 236 | 7.6 | 223 | 17.0 | 501 | 12.3 | 343 | 18.7 | 721 | 87.3 | 932 | 20.8 |
| 54 | 291 | 9.4 | 236 | 17.0 | 312 | 8.1 | 191 | 10.0 | 981 | 91.0 | 664 | 16.7 |
| 55 | 337 | 9.8 | 205 | 12.6 | 314 | 7.7 | 191 | 8.6 | 1,059 | 90.9 | 686 | 17.9 |
| 56 | 431 | 10.7 | 256 | 14.3 | 613 | 11.8 | 226 | 9.5 | 1,313 | 89.1 | 869 | 22.2 |
| 57 | 542 | 12.7 | 301 | 16.0 | 1,251 | 16.7 | 251 | 10.4 | 1,389 | 90.4 | 1,111 | 26.6 |
| 58 | 614 | 16.7 | 374 | 21.9 | 1,024 | 15.9 | 315 | 12.6 | 1,373 | 90.5 | 1,060 | 27.5 |
| 59 | 892 | 20.7 | 506 | 24.0 | 1,606 | 21.0 | 418 | 15.8 | 1,660 | 90.9 | 1,172 | 30.3 |
| 60 | 1,424 | 29.6 | 722 | 30.0 | 5,022 | 37.3 | 530 | 18.0 | 1,661 | 90.3 | 1,459 | 36.9 |
| 61 | 1,948 | 37.7 | 942 | 37.7 | 6,030 | 39.5 | 960 | 27.2 | 1,819 | 89.3 | 1,687 | 42.7 |
| 62 | 2,485 | 48.3 | 1,231 | 48.7 | 7,839 | 44.2 | 1,270 | 33.3 | 1,985 | 90.4 | 1,783 | 45.2 |

Sources : MITI, Research Division *Sekiyu tokei nenpo*, *Sekitan tokei nenpo* (Annual coal statistics), *Sekitan kokusu tokei nenpo* (Annual coal and coke statistics).

Notes: 1. Coal: Average kcal of domestic coal in each fiscal year, but in electric power, 5,600 kcal/kg. Heavy oil: 9,900 kcal/l.

2. Iron and steel industry contains coke-coal. Data excluding coke-coal consumed in iron production are shown in the next table.

Table 4. Consumption quantities of heavy oil in steel production and its percentage. (kl, %)

| Fiscal year | Open-hearth | Rolling | Steel pipe | Power generation | Boiler |
|----------------|-------------|-----------|------------|------------------|--------|
| 1951 | 345,302 | 94,145 | 0 | — | — |
| 52 | 426,470 | 151,638 | 7,592 | — | — |
| 53 | 517,385 | 276,020 | 24,910 | 6,396 | 23,928 |
| 54 | 504,672 | 318,153 | 19,989 | 8,178 | 30,430 |
| 55 | 602,149 | 367,596 | 21,809 | 4,398 | 15,825 |
| 56 | 721,927 | 455,115 | 30,936 | 6,197 | 15,721 |
| 57 | 693,565 | 517,585 | | 6,104 | 26,342 |
| 58 | 609,910 | 528,543 | | 13,541 | 37,582 |
| 59 | 800,785 | 778,078 | | 24,401 | 60,567 |
| 60 | 895,406 | 962,179 | | 26,943 | 75,612 |
| 61 | 985,951 | 1,137,879 | | 199,778 | |
| 62 | 682,381 | 1,191,859 | | 400,494 | |
| Percentage (1) | Open-hearth | Rolling | Steel pipe | Power generation | Boiler |
| 1951 | 39.7 | 16.8 | 0.0 | — | — |
| 52 | 57.6 | 31.7 | 33.0 | — | — |
| 53 | 74.3 | 54.1 | 68.3 | 2.9 | 14.6 |
| 54 | 86.5 | 69.0 | 67.1 | 2.6 | 18.9 |
| 55 | 84.7 | 74.4 | 70.6 | 1.6 | 9.8 |
| 56 | 89.6 | 78.9 | 75.0 | 2.5 | 10.1 |
| 57 | 89.9 | 81.9 | | 2.4 | 15.4 |
| 58 | 93.0 | 86.8 | | 6.5 | 18.5 |
| 59 | 94.8 | 92.9 | | 10.7 | 29.4 |
| 60 | 97.7 | 95.6 | | 10.8 | 36.5 |
| 61 | 99.2 | 96.9 | | 34.9 | |
| 62 | 99.5 | 98.4 | | 49.2 | |
| Percentage (2) | Open-hearth | Rolling | Steel pipe | Power generation | Boiler |
| 1951 | — | — | — | — | — |
| 52 | — | — | — | — | — |
| 53 | 56.3 | 33.4 | 49.2 | 1.3 | 5.2 |
| 54 | 65.4 | 42.7 | 50.9 | 1.4 | 8.3 |
| 55 | 65.7 | 46.4 | 51.7 | 0.7 | 3.8 |
| 56 | 70.0 | 49.9 | 57.6 | 1.0 | 3.2 |
| 57 | 68.5 | 50.9 | | 1.0 | 5.8 |
| 58 | 72.8 | 50.9 | | 2.4 | 7.4 |
| 59 | 76.2 | 57.1 | | 3.4 | 10.4 |
| 60 | 78.1 | 58.2 | | 3.2 | 11.2 |
| 61 | 81.0 | 55.9 | | 10.9 | |
| 62 | 82.7 | 57.5 | | 19.6 | |

Sources : MITI, Research Division, *Tekko tokei nenpo* (Annual iron and steel statist *Tekko tokei geppo* (Monthly iron and steel statistics).

Notes: 1. Percentage (1) = heavy oil/(coal+coke+heavy oil).

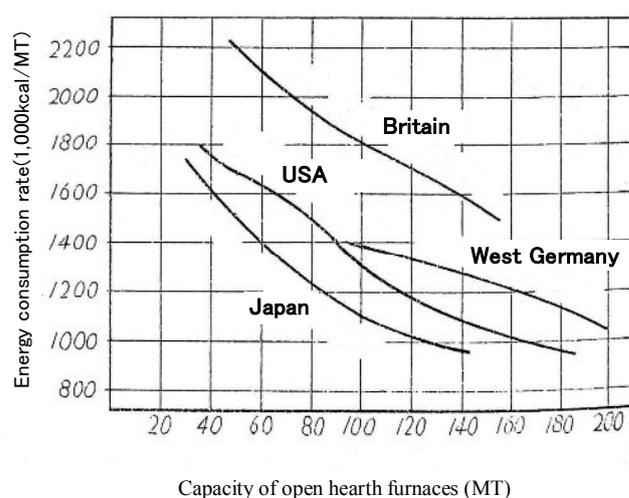
2. Percentage (2) = heavy oil/(coal+coke+heavy oil+coke oven gas+blast furnace gas).

3. Coking coal: 7,500 kcal/kg, gas-producing coal: 6,700 kcal/kg,

general-use coal: 6,300 kcal/kg, anthracite: 5,500 kcal/kg.

coke: 9,000 kcal/kg, coke-oven gas: 900 kcal/Nm³, blast-furnace gas: 4,200 kcal/

Fig. 2 Energy consumption rates of each country's open hearth furnaces in 1953



Source: Tabata, Shintaro, "Sengo junekan ni okeru seitetsu-gijutsu no sinpo ni tsuite" (Developments of the iron and steel industry's technology during the ten years after war), in *Tekkokai* (Iron and Steel Industry) March 1956, p.85.

Notes: 1. Britain and Japan: All basic open-hearth furnaces

2. USA: all open-hearth furnaces

3. West Germany: all tilting open-hearth furnaces

Table 5. Transition of MITI's plan for heavy-oil supply in the first half of fiscal year 1954 (1,000 kl, %)

| | First plan | | | Last plan | | | Modification in September |
|--|----------------------|------------------|-------------|----------------------|------------------|-------------|---------------------------|
| | Prospects for demand | Plans for supply | (2)/(1) | Prospects for demand | Plans for supply | (4)/(3) | |
| | (1) | (2) | | (3) | (4) | | Plans for supply |
| Mining and manufacturing | 1,907 | 1,353 | 70.9 | 2,086 | 1,523 | 73.0 | 1,614 |
| Large users | 1,366 | 1,010 | 73.9 | 1,486 | 1,137 | 76.5 | 1,197 |
| Small users | 541 | 343 | 63.4 | 600 | 386 | 64.3 | 417 |
| Marine and carrier | 404 | 399 | 98.8 | 404 | 399 | 98.8 | 399 |
| Agriculture, forestry and fisheries | 411 | 411 | 100.0 | 411 | 411 | 100.0 | 425 |
| Public offices | 22 | 22 | 100.0 | 22 | 22 | 100.0 | 22 |
| Security | 41 | 41 | 100.0 | 41 | 41 | 100.0 | 41 |
| Others | 103 | 64 | 62.1 | 103 | 64 | 62.1 | 64 |
| Total | 2,888 | 2,290 | 79.3 | 3,067 | 2,460 | 80.2 | 2,565 |
| <i>Major users of Mining and Manufacturing</i> | | | | | | | |
| Power generation | 161 | 81 | 50.3 | 180 | 94.5 | 52.5 | 94.5 |
| Iron and steel | 434 | 387 | 89.2 | 447 | 405.0 | 90.6 | 420.0 |
| Ceramics | 234 | 177 | 75.6 | 237 | 190.0 | 80.2 | 193.0 |
| Gas | 57 | 52 | 91.2 | 62 | 55.0 | 88.7 | 55.0 |
| Food | (a) } (b) } | } 65 | } 65.0 | 81 | 56.0 | 69.1 | 62.5 |
| | | | | 28 | 18.0 | 64.3 | 20.5 |
| Paper | 104 | 71 | 68.3 | 116 | 81.8 | 70.5 | 86.2 |
| Fabrics | 89 | 46 | 51.7 | 121 | 74.3 | 61.4 | } 127.3 |
| Chemical fiber | } 123 | } 80 | } 65.0 | 29 | 28.0 | 96.6 | |
| Chemical | | | | 112 | 76.6 | 68.4 | 76.6 |
| Machinery | 10 | 8 | 80.0 | 13 | 12.4 | 95.4 | 12.9 |
| Metal and refinement | 50 | 41 | 82.0 | 53 | 43.9 | 82.8 | 44.7 |
| Leather | 4 | 2 | 50.0 | 3 | 1.5 | 50.0 | 1.5 |
| Pending | 0 | 0 | - | 0 | 0 | - | 2.3 |
| Total | 1,366 | 1,010 | 73.9 | 1,486 | 1,137.0 | 76.5 | 1,197.0 |

Sources: The Coordinating-Supplies Division, "Showa 29-nendo kamiki juyū kyōkyū keikaku (an)" (Interim plans for heavy-oil supply in the first half of fiscal year 1954), May 28, 1954, "Showa 29-nendo kamiki kou-kōgyō-bumon juyū kyōkyū keikaku (an)"

(unpublished), Sekiyū Keizai Shinbun, June 29, July 10, November 9, 1954.

Note: 'Food (a)' is authorized by the Ministry of Agriculture and Forestry, and 'Food (b)' is authorized by the Internal Revenue Service.

Table 6. Indices of coal-using costs with heavy oil being 100 calculated by MITI

| Facility | Item | Unit | Place | At the present condition | After a decrease of 20% in coal price |
|-----------------------|----------------|-------|--------|--------------------------|---------------------------------------|
| Open-hearth furnace | Ingot | ton | Osaka | 108 | 106 |
| | Bar | ton | Osaka | 116 | 113 |
| Heat-treating furnace | Wire rod | ton | Osaka | 124 | 119 |
| | Plate | ton | Osaka | 117 | 115 |
| Glass-furnace | Sheet glass | case | Tokyo | 133 | 127 |
| | Glassware | ton | Osaka | 119 | 113 |
| Sintering furnace | Firebrick | ton | Osaka | 120 | 117 |
| | Pottery | ton | Nagoya | 119 | 115 |
| Boiler | Dyed goods | month | Tokyo | 103.5 | 101 |
| | Soap | ton | Tokyo | 100 | 99.3 |
| | Fat and grease | ton | Tokyo | 100 | 99.7 |

Source: Coordinating-Supplies Division "Sekitan tenkan no seizo-genka ni oyobosu eikyo (shisan)"

(Trial calculations of the influences of conversion to coal upon production costs) December 12 1954 (unpublished).

Note: According to materials for particular factories, presented by each Bureau.

Table 7. MITI's plans for supply-and-demand of heavy oil

(1,000kl)

| Fiscal year | 1954 | 55 | 56 | 57 | 58 | 59 | 60 |
|--|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Power generation | 338 | 385 | 360 | 320 | 300 | 300 | 300 |
| Gas | 143 | 163 | 210 | 200 | 190 | 180 | 180 |
| Cement | 155 | 45 | 20 | 20 | 20 | 20 | 20 |
| Big boiler | 720 | 600 | 460 | 340 | 320 | 310 | 310 |
| Small boiler and heating | 1,062 | 867 | 720 | 610 | 570 | 530 | 500 |
| Subtotal | 2,418 | 2,060 | 1,770 | 1,490 | 1,400 | 1,340 | 1,310 |
| Big furnace in mining and manufacturing | 1,287 | 1,307 | 1,380 | 1,450 | 1,530 | 1,610 | 1,690 |
| Marine and carrier | 648 | 630 | 660 | 690 | 710 | 730 | 760 |
| Agriculture, forestry and fisheries | 956 | 1,010 | 1,090 | 1,150 | 1,220 | 1,280 | 1,350 |
| Public offices, defence, construction and correspondence | 141 | 143 | 150 | 170 | 170 | 180 | 190 |
| Subtotal | 3,032 | 3,090 | 3,280 | 3,460 | 3,630 | 3,800 | 3,990 |
| Total | 5,450 | 5,150 | 5,050 | 4,950 | 5,030 | 5,140 | 5,300 |

Source: Mining Bureau, Oil Division, "Juyū no jūkyū mitoshi" (Prospects for supply-and-demand of heavy oil), May 20th 1955 (unpublished).

Notes: 1. Some numbers in fiscal years 1955-1956 are modified by "Showa 29-35nendo juyū juyū mitoshi" (Prospects of demand for heavy oil in fiscal years 1954-1960) (unpublished).

2. In fiscal year 1955, there is the other 50 thousand kl of heavy oil for reservation.

Table 8. The main oil importing ports of the West and Japan in 1956

| Nation | Port | Capacity for loading (kl/h) | Depth of waterway (m) | Depth of berth (m) | capacity for tanker (D/W) |
|-------------|------------------|-----------------------------|-----------------------|--------------------|---------------------------|
| USA | Philadelphia | 3,000 | 10.7 | 10.7 | 45,000 |
| | New York | 3,000 | 12.2- | 10.7 | 45,000 |
| | Portland | 3,000 | 10.7-12.2 | 10.7-12.2 | 45,000 |
| | San Francisco | 3,000 | 12.2 | 10.7 | 45,000 |
| Britain | Fawley | 3,000 | 10.7 | 10.7 | 40,000 |
| | Finnant | 1,000 | 13.7 | 12.2 | 47,000 |
| Netherlands | Rotterdam=Pernis | 3,000 | 11.0 | 9.1-10.7 | 40,000 |
| France | Le Harve | 2,000 | 7.6 | 9.1-10.7 | 33,000 |
| | Port de Bouc | 3,000 | 12.2 | 12.2 | 47,000 |
| Japan | Yokohama | 1,000 | 8.8 | 10.7 | 20,000 |
| | Kawasaki | 600 | 9.1 | 9.9-10.4 | 20,000 |
| | Shimizu | 700 | 14.0- | 12.1 | 45,000 |
| | Yokkaichi | 800 | 9.1 | 10.0 | 24,000 |
| | Shimotsu | 800-2,000 | 12.2- | 10.1-12.0 | 45,000 |
| | Kudamatsu | 400 | 13.0- | 9.8 | 32,000 |
| | Iwakuni | 500 | 10.0 | 11.0 | 38,000 |

Source: karino, Tadashi, "Tanka cho oogata-ka no keiko to sono saisan-sei ni tsuite"

(The super-bigger tendency of tankers and its profitability) in *Kaiun* (Shipping),

November 1956, p.41.